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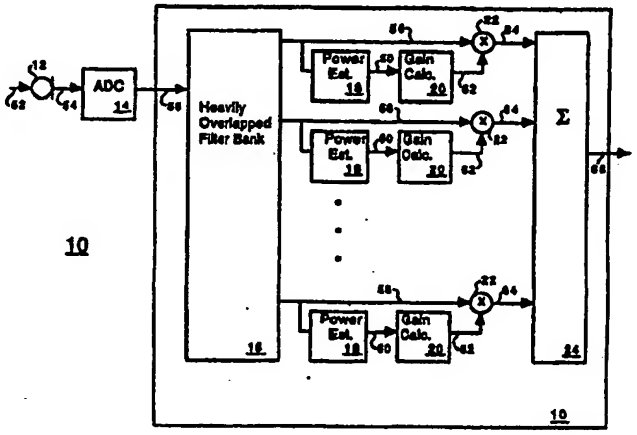

(57) Abstract

An improved multiband audio compressor (10) is well behaved for both wide band and narrow band signals, and shows no undesirable artifacts at filter crossover frequencies. The compressor includes a heavily overlapped filter bank (16), which is the heart of the present invention. The filter bank filters the input signal (56) into a number of heavily overlapping frequency bands (58). Sufficient overlapping of the frequency bands reduces the ripple in the frequency response, given a slowly swept sine wave input signal, to below about 2 dB, 1 dB, or even 0.5 dB or less with increasing amount of overlap in the bands. Each band is fed into a power estimator (18), which integrates the power of the band and generates a power signal (60). Each power signal is passed to a dynamic range compression gain calculation block (20), which calculates a gain (62) based upon the power signal. Each band is multiplied by its respective gain in order to generate scaled bands (64). The scaled bands are then summed to generate an output signal (68).

plotted with x's again. Filter 1007 is plotted with squares. Filter 1008 is plotted with pluses. Filter 1009 is plotted with left-pointing triangles again. Filter 1010 is plotted with asterisks. Filter 1011 is plotted with pluses again.

Figure 11 shows the swept sine response 1101 of the compressor configuration of Figure 10. We see that the ripple has been reduced to less than one half dB for the 4 to 1 compressor. In the case of a compression ratio of 1.5, the ripple would be reduced to less than one quarter of a dB.

Figure 12 shows a digital hearing aid which utilizes the continuous frequency dynamic range audio compressor 10 having heavily overlapped filter bank 16 of Figure 7. The hearing aid of Figure 12 includes a microphone 1202 for detecting sounds and converting them into analog electrical signals. Analog to digital (A/D) converter 1204 converts these analog electrical signals into digital signals. A digital signal processor (DSP) 1206 may accomplish various types of processing on the digital signals. It includes audio compressor 10 having heavily overlapped filter bank 16, as shown in Figure 7. The processed digital signals from DSP 1206 are converted to analog form by digital to analog (D/A) converter 1208, and delivered to the hearing aid wearer as sound signals by speaker 1210.

In the Appendix we analyze in depth the reasons for the dramatic reduction in ripple with increase in filter overlap. We will briefly summarize these reasons here. We can think of calculating the gain for a multiband

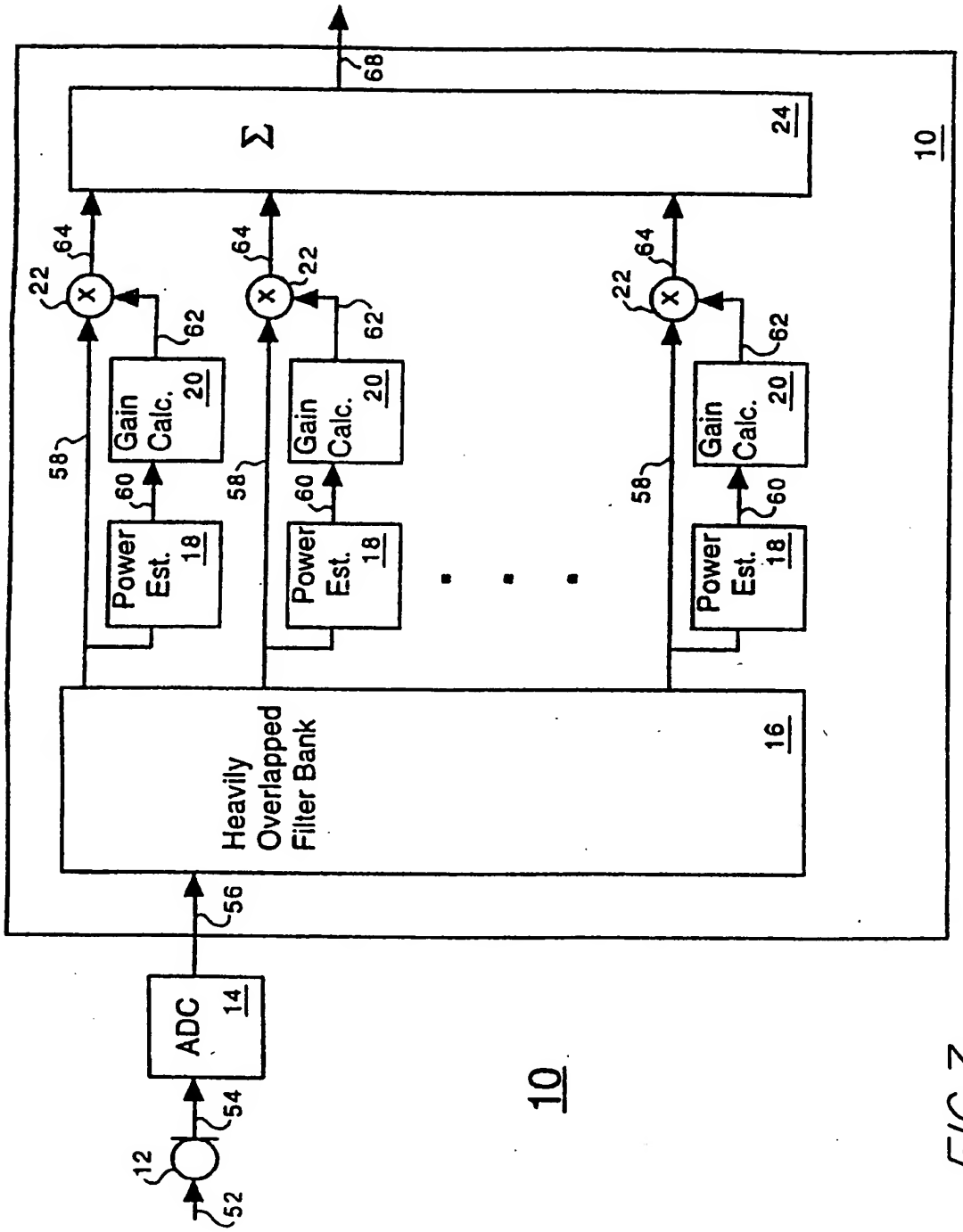

FIG. 7